The Design of Power Decision Support System Based on Data-warehouse

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Abstract. Comprehensive application of technology of data warehouse and OLAP Technology (OLAP), design of decision-making support system of electric power, put forward the plan to realize the system and architecture, and discusses the prospects of applications and OLAP services integration of key technologies, namely how to access the data cube in the multidimensional data and how to manage the metadata to control the OLAP service. In addition, from the efficiency and flexibility of the two perspectives are given based on database and data warehouse based on the analysis of the performance comparison.

1. Introduction

Currently, using advanced energy management system (EMS) for power system monitoring and management.EMS in long-term continuous operation, the database has accumulated huge amounts of data, but there is no effective means of using these data for decision support services[1]. Therefore how to use these data to support decision making information system resources is an important problem facing the staff. This problem not only requires on-line service, but also involves a great deal of data for decision-making, and EMS of the traditional database system can't satisfy the demand of. In this paper, using the data warehouse and OLAP to build electric power decision support system and its application to the actual, for the power system to provide effective means of decision support[2].

2. Overview of data warehouse and OLAP

2.1 Summary of data warehouse

Data warehouse based on strategic information needs, and is looking to provide such information as a result of the new method. It is a diverse mix of technologies, is a kind of environment, rather than the product. Comparison of accepted definition of data warehouse is: a data warehouse is a subject-oriented, integrated, stable, time-variant collection of data in support of management, the decision making process.

The data warehouse system based on data warehouse, data screening tools, data conversion tool, query tools, reporting tools, analysis tools and data mining tools, to meet customer demand for a variety of information. Data warehouse architecture can be used to map the structure of Fig. 1 shown. Data from a variety of sources to obtain the raw data, after finishing, stored in the data warehouse of the internal information library, through the analysis of data warehouse, data

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warehouse users to provide a unified, coordinated and integrated information environment, support the whole of the decision-making process and management further comprehensive analysis.

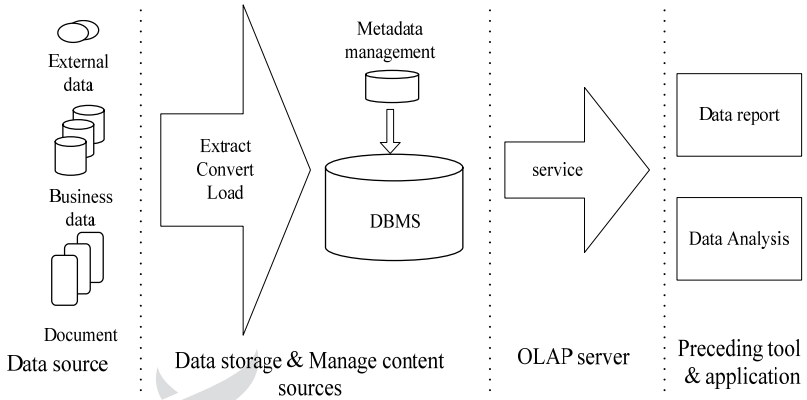

Fig. 1. Architecture of data warehouse

2.2 Summary of OLAP

OLAP (On-Line Analytical Processing, OLAP) is targeted at specific issues of on-line data access and data analysis to produce a technology, is one of the important techniques in electric power decision support, which is based on data warehouse as a platform, to query, analysis for characteristics, with summary, merge and polymerization function, according to the decision makers of information demand, provide accurate real-time information[4]. Through the online analytical processing, data analysis, enterprise managers and decision makers to fast, consistent, interactive access to business data in the data warehouse, the realization of the data point of the induction, analysis and processing, master the rule, to make the final decision.

OLAP significant feature is that it can provide the data of multidimensional conceptual view (multidimensional).Victoria is the specific angle of observation data, at the same time, "dimension" also has a level of. People to observe the data of a certain angle exists different degree of multiple details description of levels, called the multiple layers of description as "dimension" level.

OLAP second features is that it can quickly response (fast) user analysis request. Is generally believed that OLAP should be within a few seconds of user analysis request response.

OLAP third is characterized by its functional analysis (analysis).This is a OLAP system can provide the user with powerful statistics, analysis, report processing function. In addition, OLAP system also has the answer "assumption -- Analysis of" (what-if) the function and trend prediction ability.

OLAP fourth features shared characteristics, this refers to the OLAP system should have very high security.

OLAP fifth features of his information, which refers to the OLAP desired data and derives useful information.

2.3 Data warehouse and its relationship with OLAP

In the technology of data warehouse, data warehouse and OLAP are closely linked, interconnected. On one hand, the data warehouse OLAP data base, for the latter provided effective data sources, although the on-line analytical processing does not have to establish a data warehouse, but based on the data warehouse on line analysis processing is the easiest and most effective; on the other hand, only through the online analytical processing ability further realization of the value of the data warehouse, or establish a separate data warehouse plays the role of decision support.

3. System scheme

3.1 The structure of electric power decision support system

Electric power decision support system is a business oriented analysis personnel, business management, decision-making system, through the power of the production information mining, analysis, to obtain the useful information for managers, managers decision-making to provide real-time, science, effective information support. Decision support system functions completely independent of management information system or any business system, but its decision-making behavior and must rely on enterprise information database management information system for data collection, and the actual use, decision support system can make up for the function of the management information system is insufficient, therefore, can be said that the decision support system is a management information system extension, decision support system is usually in the solution of management information system can not solve the problem.

Power and decision-making is the core work of the historical data of power consumption for customers, business data as well as the effects of electricity demand for a variety of reasons were analyzed, the electric power market demand forecasting, integrated analysis data, generates decision need basis and decision, and through the logic optimization, optimal solution, thereby enabling the auxiliary decision analysis on issues related to effectively reduce decision-making, decision-making blindness.

OLAP based electric power decision support system based on data warehouse in power, using OLAP technology as a decision support tool. Based on the OLAP system enables a user from a data warehouse is presented in the data, analyzing the decisions. System structure with three layers client/server architecture. The first layer is a client, support OLAP operations, such as slices, cut, rotation, trend analysis, comparison and other processing. The second layer is the analysis server, data warehouse for storage of data. The third layer is the enterprise server, he comes from the primary database.

The design target of the system is mainly based on OLAP multidimensional analysis technology based on, other auxiliary to data mining and statistic prediction model to realize comprehensive analysis. While OLAP the key problem is how to organize the data warehouse in the integrated data, in order to satisfy the client user multidimensional data analysis needs, i.e. OLAP server design; the two is the OLAP server software communication.

3.2 System based on data warehouse and OLAP design

According to the demand analysis, we adopt the popular star pattern. Star schema is based on a relational database for online analysis, is a kind of multidimensional data organization form. Relational structure can better adapt the multidimensional data representation and storage. The relational database will in a multidimensional database structure is classified into two categories: one category is the fact table table, used to store the fact measure and every dimension code value, another kind is the dimension table, for each dimension, at least one table is used to save the dimension information is described, including the dimension hierarchy and dimension member category. In the fact table in these values can be derived from the dimension columns. The fact table is through every dimension code value dimension table together, the structure is known as the "star pattern".

In a local factory electric power decision support system data warehouse development as an example. And the selected five related dimensions -- time, load location, load voltage grade, type and line, the star model and physical model are respectively in Fig. 2 and Fig. 3.

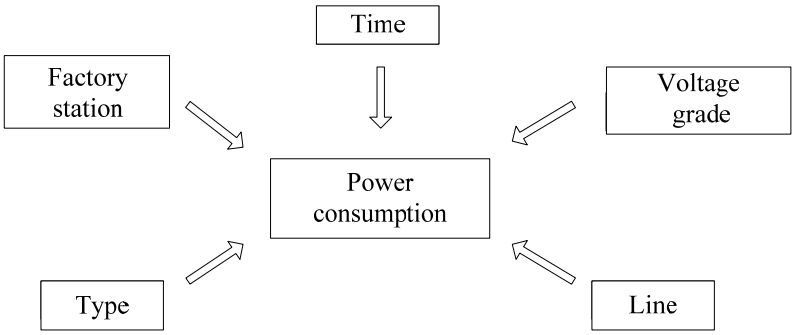

Fig. 2. The star model

Fig. 2, intermediate representation power fact, around said related information (time, type, line, time, voltage level for each dimension), have their own properties, dimension tables and fact through keyword associated. Star model is the core of the fact table (fact table), it is according to the dimension of the center storage query -- real data that fact. Facts for numeric attributes, such as maximum, minimum power and total power. The fact table attribute contains the appropriate on the fact table content managed by the numeric value. The use of the star model users can improve query performance and convenient to arrange various complex query. Because of the fact table includes data, so long as the scan fact table can query, without the need for a large table together, at the same time dimension tables are generally small, with the truth table for connection when the speed is very fast, can greatly improve the query speed. On the other hand, the star model more intuitive, so that the user can be combined into various query, such as by departments, time, voltage level, can be analyzed in different time of various departments of the voltage difference, so as to the economic operation of electric power systems to provide decision support.

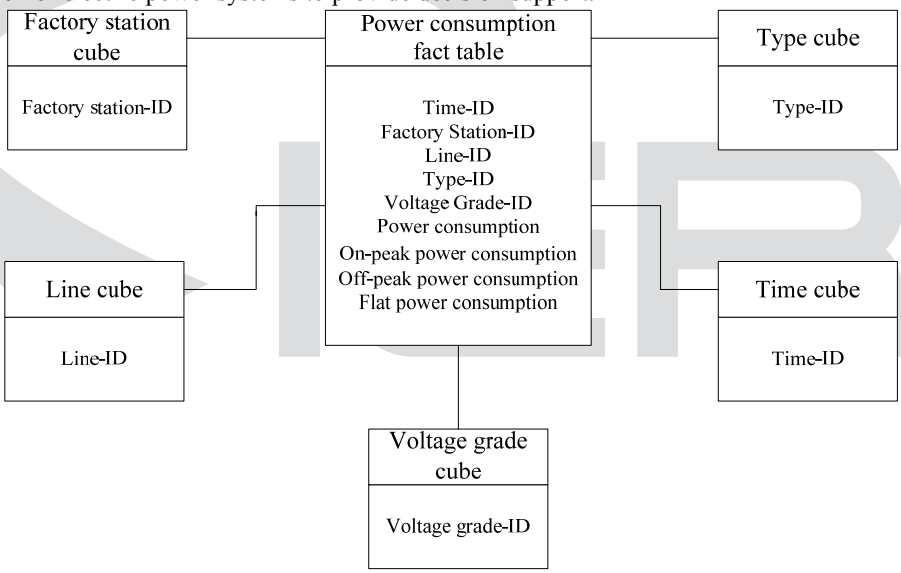

Fig. 3. The physical model

3.3 The OLAP system object component design

In the star model of data warehouse based on the definition and the creation of OLAP cube. To load with n OLAP cube as an example, the cube of the time axis from the time of cone axis load, load department from the Department cone, and the electrical signal from the electrical signal cone axis.

If you keep cube two axis and third axis different value, can see measurement in different temporal changes. If you keep power load time and electric signal is constant, along the load station coordinate axis can be obtained by the production department at a certain time load electricity use all value, thereby allowing the cube dimension attributes to analyze data.

Design of OLAP system by using the object-oriented technology, the OLAP system consists of four components. The first component is the user interface, is an OLAP front-end tool part. The other three components are used for data service, respectively connected component object, metadata object component and OLAP cube object component. The OLAP system user interface components to provide users with access and query OLAP data cube man-machine interface, the other three data service component object provides access and query the data cube method.

The connection object component is reaction database, server and user connection information attribute module. Through access to the controls needed services and the control of the return value, can be the name of the database, OLAP server name such as the establishment of information required for connection. The connection object component attributes include: data warehouse, supplier name, server name, the cube name, username and password.

Metadata object component is required in a cube query metadata, a cube metadata includes information of each dimension, a dimension member such that the cube structure data, can be provided to users of this information, so that they can select the desired dimension. Metadata object component properties including cube name and dimension of.

Cube data object components can be extended through a multidimensional (MDX) query to retrieve the power required for data warehouse data. MDX queries are based on the dimension, measure, and the user-selected slice dimensions above. Cube data object properties of the component include: cube axis, multi-dimensional cube and query expansion slice per cube combination. Cube data object component also includes two objects: A cube axis information to reflect the Axes object , the other is to reflect the information cube axis tuples Tuples object. These two objects are used to manage the cube axis and the axis of the cube tuples.

4. The End

OLAP is the 1990s in the rise of a foreign software technology for the development of decision support systems to provide a favorable and comprehensive application of the technical basis. Data using the power of OLAP technology for multi-level, multi-angle, full analysis, to help power companies in-depth and comprehensive analysis of business data to the scientific, quick to point out problems, risks and to discover important trends in the formation of highly value the strategic decision-making information for the economic operation of electric power to provide a favorable decision support tools.

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